

WHAT IS CLAIMED IS:

1. A search method comprising the acts of:
 - a) using N bits, N being an integer, from a packet as an index into a data structure including a Direct Table with at least one entry and a tree structure operatively coupled to said one entry;
 - b) setting a threshold based upon a first predetermined characteristic of the tree structure;
 - c) using select bits from the packet to traverse said tree structure until the threshold is met;
 - d) storing in a Contents Address Memory (CAM) at least one entry based upon a predetermined characteristic of the packet and a second predetermined characteristic of said tree structure; and
 - e) using the at least one entry to access a memory location whereat action to be taken relative to the packet is stored.
2. The method of Claim 1 wherein N includes the first sixteen bits of a Destination MAC Address.
3. The method of claim 2 wherein the tree structure includes a plurality of nodes and leaves operatively coupled to selected nodes.

- 1 4. The method of claim 3 further including Pattern Search Control Blocks (PSCBs) carrying
2 search information positioned at selected nodes.
- 1 5. The method of Claim 1 wherein the first predetermined characteristic includes nodes and
2 the threshold is set to a count of the nodes.
- 1 6. The method of Claim 2 wherein the selected bits include the remaining thirty two bits of
2 the Destination MAC Address.
- 7 7. The method of Claim 2 wherein the second predetermined characteristic includes leaves.
- 1 8. A method for correlating a search key with a database comprising the acts of:
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- a) using N bits, $N \geq 1$, from the search key as an index into the database including entries having a Direct Table with at least one entry and a tree structure operatively coupled to said one entry;
 - b) setting a threshold based upon a first predetermined characteristic of the tree structure;
 - c) using M bits ($M > 1$) from the search key to access said tree structure until the threshold is met; and
 - d) reading from a CAM information that indicates action to be taken relative to the search key.

1 9. The method of claim 8 wherein the search key includes a portion of a data packet.

1 10. The method of claim 9 wherein the information includes the address of a leaf in which the
2 action is stored.

1 11. The method of claim 8 wherein the reading step further includes the step of using the N
2 bits as index into the CAM.

12. An apparatus comprising:

an embedded processor complex including a plurality of protocol processors;

a control point processor operatively coupled to the processor complex;

a plurality of hardware accelerator co-processors accessible to each protocol
processor and providing high speed pattern searching, data manipulation and frame
parsing;

at least one memory device, operatively coupled to the processor complex, that
stores data structures including a Direct Table, nodes and leaves operatively chained
together; and

a Memory location operatively coupled to the processor complex and storing a
value representative of the maximum number of nodes to be accessed during a tree search
routine.

1 13. The apparatus of claim 12 further including a Contents Address Memory (CAM)
2 operatively coupled to the processor complex and storing a pointer identifying a location
3 whereat a leaf is stored.

1 14. The apparatus of claim 13 wherein the leaf contains information on actions to be taken
2 relative to a packet.

1 15. The apparatus of claim 14 wherein the CAM further includes an indicia paired with the
2 pointer, said indicia being selected from a portion of the packet.

1 16. The apparatus of Claim 15 wherein the indicia includes a portion of a Destination MAC
2 Address in the packet.

1 17. The apparatus of Claim 15 further including a circuit that deletes pointers from the CAM
2 based upon leaf adjustments in the tree structure and/or NONE use of the information
3 within a predetermined time interval.

1 18. The apparatus of Claim 17 wherein the leaf adjustments include deletion.

1 19. The apparatus of Claim 12 wherein the Control Point Processor is programmed to
2 generate and forward frames containing information that adjusts the data structure.

1 20. The apparatus of Claim 19 wherein the adjustment includes leaf deletion and/or insertion.

1 21. A data structure comprising:

2 a Direct Table having at least two entries;

3 a tree structure operatively coupled to the at least two entries and having a
4 plurality of nodes and leaves operatively chained together; and

5 a storage storing a threshold value indicating the maximum number of nodes to be
6 accessed during a walk of said tree structure.

7 22. The data structure of Claim 21 further including Contents Address Memory, CAM, in
8 which leaf information is stored if the leaf is connected to a node above the threshold
9 value.

1 23. The data structure of Claim 22 further including a co-processor responsive to at least a
2 command to use part of the DA of a packet to index into the DT and the remaining part of
3 said DA to search the associated tree, said co-processor selecting, information stored in a
4 leaf if the leaf is attached to a node below the threshold value or selecting information
5 stored in the CAM if the leaf is attached to a node above the threshold value.

1 24. A system comprising:

2 a processor to provide a key extracted from a data packet;

3 a tree walk logic responsive to use the key to walk a tree structure until a
4 threshold is reached;

5 a CAM controller to use the key to search a CAM; and

6 a controller that uses the first available result from the tree walk logic or the CAM
7 controller to determine an action to be taken relative to the data packet.

1 25. A search method comprising the acts of:

2 (a) providing a key extracted from a data packet;

3 (b) using said key by a tree walk logic to search a tree structure until a threshold is
4 reached;

5 (c) using said key by a CAM controller to search a CAM; and

6 using the first result from acts (b) or (c) to determine an action to be taken relative to the
7 data packet.